

Figure 1: Surface of a silicon device. Left hand side: surface topography roughened intentionally, right hand side: surface topography post exposure to the etching paste. It turns out that the surface topography is significantly smoothed in comparison to the left hand side's topography.

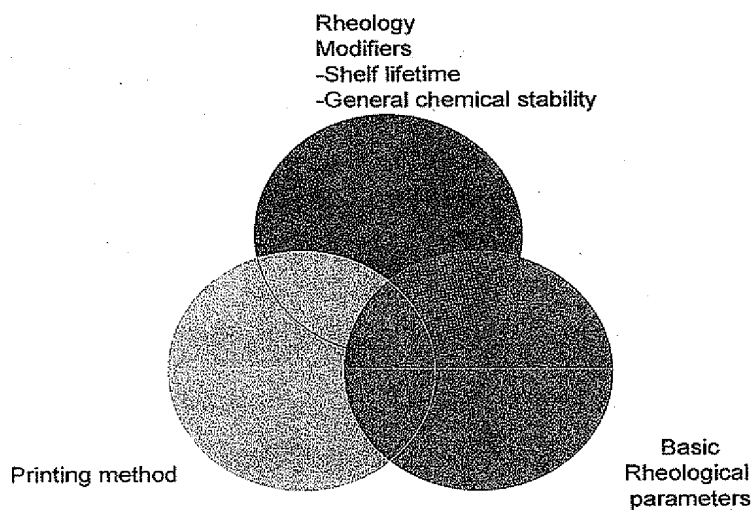


Figure 2: Simplified chart depicted to visualize potential interactions with respect to paste formulation engineering.

2. Examples according to the present invention

In the following further examples are given, which are within the bounds of the presently disclosed invention and of the claims.

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a. Example 6

40 g of 47 % aqueous solution of KOH

30.2 g of deionised water

10 0.6 g of Propane-1,2-diol

2.7 g of Carbomer-type 1 (acrylic acid homopolymer)

The batch and processing were carried out as described in Example 1.

15 The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 5 min at an etching temperature of 75 °C. The etching depth determined on production of etch structures with a line width of 1 mm is about 1.3 μm on a silicon wafer.

b. Example 7

20

38.5 g of 47 % aqueous solution of KOH

25 g of 10 % aqueous solution of tetraethyl ammonium hydroxide

10 g of deionised water

0.4 g of ethyleneglycol monobutyl ether

25 0.3 g of ethyleneglycol monoethyl ether

1.7 g of Carbomer-type 1 (acrylic acid homopolymer)

1.4 g of Carbomer-type 1 (acrylic acid homopolymer)

The batch and processing were carried out as described in Example 1.

30 The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 2 min at an etching temperature of 130 °C. The etching depth determined on production of etch structures with a line width of 1 mm is about 1.2 μm on a silicon wafer.

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c. Example 8

50 g of 47 % aqueous solution of KOH

11 g of NaOH

110 g of deionised water

40 2 g of glycerol

0.3 g of 4-hydroxy-4-methyl-2-pentanone

5.9 g of Carbomer-type 1 (acrylic acid homopolymer)

1.7 g of Carbomer-type 1 (acrylic acid homopolymer)

The batch and processing were carried out as described in Example 1.

5 The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 5 min at an etching temperature of 130 $^{\circ}\text{C}$. The etching depth determined on production of etch structures with a line width of 2 mm is about 3.1 μm on a silicon wafer.

10 d. Example 9

25 g of 47 % aqueous solution of KOH

25 g of monoethanol amine

35.6 g of deionised water

15 0.6 g of 4-hydroxy-4-methyl-2-pentanone

0.5 g tributyl phosphate

0.3 g sodium docylsulfate

1.3 g of Carbomer-type 1 (acrylic acid homopolymer)

3.2 g of Carbomer-type 1 (acrylic acid homopolymer)

20 The batch and processing were carried out as described in Example 1.

The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 2 min at an etching temperature of 110 $^{\circ}\text{C}$. The etching depth determined on production of etch structures with a line width of 4 mm is about 1.6 μm on a silicon wafer.

25 e. Example 10

8 g of 47 % aqueous solution of KOH

30 8 g of 25 % aqueous solution of tetramethyl ammonium hydroxide

65 g of deionised water

0.5 g of butane-1,4-diol

0.3 g polydimethyl siloxane

0.1 g sodium dodecylsulfate

35 4.9 g of Carbomer-type 1 (acrylic acid homopolymer)

1.3 g of Carbomer-type 1 (acrylic acid homopolymer)

The batch and processing were carried out as described in Example 1.

40 The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 5 min at an etching temperature of 150 $^{\circ}\text{C}$. The etching depth determined on production of etch structures with a line width of 2 mm is about 1.1 μm on a silicon wafer.

f. Example 11

35.1 g of 47 % aqueous solution of KOH
26 g of monoethanol amine
83 g of deionised water
62 g of diprolyleneglycol monoethyl ether
4.3 g of Carbomer-type 1 (acrylic acid homopolymer)
1.1 g of Carbomer-type 1 (acrylic acid homopolymer)

The batch and processing were carried out as described in Example 1.

The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 2 min at an etching temperature of 140 $^{\circ}\text{C}$. The etching depth determined on production of etch structures with a line width of 1 mm is about 0.9 μm on a silicon wafer.

It can be concluded from this comparative example that the etching characteristic drops when using mixtures of aqueous inorganic and organic etchants additionally composed with a significant mass fraction of organic co-solvents.

g. Example 12

55 g of 47 % aqueous solution of KOH
12 g of deionised water
28.7 g of glycerol
4.3 g of Carbomer-type 1 (acrylic acid homopolymer)
1.3 g of carboxymethylcellulose

The batch and processing were carried out as described in Example 1.

The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 2 min at an etching temperature of 140 $^{\circ}\text{C}$. The etching depth determined on production of etch structures with a line width of 1 mm is about 0.6 μm on a silicon wafer.

It can be concluded from this comparative example that the etching characteristic drops when using aqueous inorganic etchants additionally composed with a significant mass fraction of organic co-solvents.

h. Example 13

- 5 42.5 g of 47 % aqueous solution of KOH
- 11 g of deionised water
- 3.2 g of butane-1,4-diol
- 1.8 g of Carbomer-type 1 (acrylic acid homopolymer)
- 0.6 g of Carbomer-type 2 (acrylic acid homopolymer)
- 10 1.7 g of carboxymethylcellulose

The batch and processing were carried out as described in Example 1.

- The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 2 min at an etching temperature of 140 $^{\circ}\text{C}$. The etching depth
- 15 determined on production of etch structures with a line width of 1.5 mm is about 1.7 μm on a silicon wafer.

i. Example 14

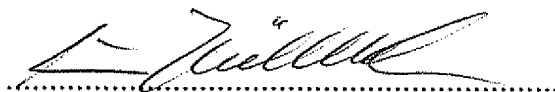
- 50 g of 47 % aqueous solution of KOH
- 20 95 g of deionised water
- 1.5 g of diprolyleneglycol monoethyl ether
- 1.2 g 4-hydroxy-4-methyl-2-pentanone
- 6.1 g of Carbomer-type 1 (acrylic acid homopolymer)
- 1.6 g of Carbomer-type 2 (acrylic acid homopolymer)
- 25 1.7 g of carboxymethylcellulose

The batch and processing were carried out as described in Example 1.

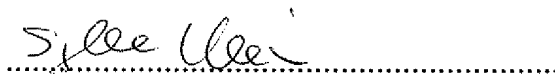
- The etching paste was applied to the silicon surface by using a dispenser (pin diameter 450 μm) and etched 5 min at an etching temperature of 150 $^{\circ}\text{C}$. The etching depth
- 30 determined on production of etch structures with a line width of 3 mm is about 2.9 μm on a silicon wafer.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 05.11.10

A handwritten signature in black ink, appearing to read 'Armin Kübelbeck', written over a horizontal dotted line.

Armin Kübelbeck

A handwritten signature in black ink, appearing to read 'Sylke Klein', written over a horizontal dotted line.

Sylke Klein